

AMENDMENTS TO THE CLAIMS

Presented below is a complete set of claims with current status indicators.

1. (previously presented) In an implantable cardiac stimulation device coupled to cardiac leads from which atrial and ventricular channel signals are generated, a method comprising:
  - tracking refractory periods within both the atrial and ventricular channel signals; and
  - determining an atrial rate using unipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods.
2. (original) The method of claim 1 wherein determining the atrial rate using unipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods is only performed if automatic mode switching (AMS) is enabled in the implantable stimulation device or if an atrial high rate detection diagnostic event counter is enabled, otherwise the atrial rate is determined based only on events outside the refractory periods sensed via unipolar sensing.
3. (previously presented) The method of claim 1 wherein determining the atrial rate using unipolar sensing based on events outside the refractory periods comprises:
  - identifying events occurring only on the atrial channel outside of the refractory periods;
  - identifying events occurring simultaneously on the atrial and ventricular channels outside of the refractory periods; and
  - determining an atrial rate by counting events that occur only on the atrial channel and while ignoring events that occur simultaneously on the atrial and ventricular channels.

4. (previously presented) The method of claim 1 further comprising opening relative refractory windows within the atrial and ventricular refractory periods and wherein using combined unipolar/bipolar sensing within the refractory periods only applies to events within the relative refractory windows of the refractory periods.

5. (previously presented) The method of claim 4 wherein using combined unipolar/bipolar sensing comprises:

identifying events sensed only on the atrial channel within the relative refractory windows as being true atrial events and counting the event for the purposes of atrial rate calculation;

identifying events sensed simultaneously on the atrial and ventricular channels within the relative refractory windows as being a ventricular event and ignoring for the purposes of atrial rate calculation; and

identifying events sensed only on the ventricular channel within the relative refractory windows as being noise and ignoring for the purposes of atrial rate calculation.

6. (original) The method of claim 5 wherein, upon the identification of an event as being noise, a noise response function is activated.

7. (previously presented) The method of claim 4 wherein opening atrial and ventricular relative refractory windows within the atrial and ventricular signals comprises:

detecting an R wave on the ventricular channel;

initiating atrial and ventricular blanking intervals on the atrial and ventricular channels, respectively, following detection of the R wave for a predetermined blanking period of time; and

initiating atrial and ventricular relative refractory windows on the atrial and ventricular channels, respectively, immediately following completion of the atrial and ventricular blanking intervals for a predetermined relative refractory duration of time.

8. (original) The method of claim 7:

wherein the ventricular blanking interval has a duration shorter than an average R-T interval occurring during normal sinus rhythm; and

wherein the ventricular blanking interval and the relative refractory window together have a combined duration longer than the average R-T interval of normal sinus rhythm such that the T-wave typically occurs during the ventricular relative refractory window.

9. (original) The method of claim 7 wherein the atrial blanking interval has a duration equal to the ventricular blanking interval and the atrial relative refractory window has a duration equal to the ventricular relative refractory window such that the T-wave typically occurs during the atrial relative refractory window.

10. (previously presented) The method of claim 1 further comprising comparing the atrial rate against atrial tachycardia detection threshold (ATDR) threshold and performing a mode switch if the rate crosses the ATDR threshold.

11. (currently amended) In an implantable cardiac stimulation device, a system comprising:

a ventricular sense amplifier operative to sense ventricular channel signals; and  
an atrial sense amplifier operative to sense atrial channel signals;  
a control unit operative to track refractory periods within atrial and ventricular channel signals; and  
an atrial rate determination unit operative programmed to determine an atrial rate using unipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods.

12. (currently amended) In an implantable cardiac stimulation device, a system comprising:

means for sensing ventricular channel signals;  
means for sensing atrial channel signals;  
means for tracking refractory periods within atrial and ventricular channel signals;  
and

means programmed for determining an atrial rate using unipolar sensing outside the refractory periods and using combined unipolar/bipolar sensing within the refractory periods.

13. (previously presented) The method of claim 1 wherein determining the atrial rate using unipolar sensing based on events outside the refractory periods comprises only counting events that occur only on the atrial channel.

14. (previously presented) The method of claim 4 wherein using combined unipolar/bipolar sensing comprises counting events sensed only on the atrial channel within the relative refractory windows for the purposes of atrial rate calculation.

15. (previously presented) The method of claim 4 wherein using combined unipolar/bipolar sensing comprises ignoring events sensed simultaneously on the atrial and ventricular channels within the relative refractory windows for the purposes of atrial rate calculation.

16. (previously presented) The method of claim 4 wherein using combined unipolar/bipolar sensing comprises ignoring events sensed only on the ventricular channel within the relative refractory window for the purposes of atrial rate calculation.

17. (previously presented) The device of claim 11 wherein the atrial rate determination unit is operative to count events sensed only on the atrial channel within the refractory periods for the purposes of atrial rate calculation.

18. (previously presented) The device of claim 11 wherein the atrial rate determination unit is operative to ignore events sensed simultaneously on the atrial and ventricular channels within the refractory periods for the purposes of atrial rate calculation.

19. (previously presented) The device of claim 11 wherein the atrial rate determination unit is operative to ignore events sensed only on the ventricular channel within the refractory periods for the purposes of atrial rate calculation.